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TREATING COSTS AND DURABILITY TESTS OF HAWAII-GROWN WOOD POSTS TREATED BY DOUBLE-DIFFUSION

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ABSTRACT: Wood posts of 10 common Hawaii-grown species were treated by the double-diffusion process. The cost of debarking and chemical treatment was determined. The treated posts were set out with untreated posts at Makiki Valley, Honolulu, to test their service life. Preliminary results after six months of exposure are reported.

How can wood posts in Hawaii be made more durable? One method is to treat them with preservative by double-diffusion. This process was developed over 20 years ago by the Forest Products Laboratory of the U.S. Forest Service, and has produced longer life in pine posts than any other cold, nonpressure treatment so far tested.[1] Double-diffusion treatment can be done on a farm or a ranch. It is suitable for treating complete posts in vats or butt ends only in barrels. We recommend only full length treatment in vats, because posts often decay above the ground in the wet parts of Hawaii almost as rapidly as at the ground line.

1/ Blew, J. O., and Kulp, J. W. Comparison of wood preservatives in Mississippi post study. U.S. Forest Serv. Forest Products Lab. Rpt. 1757, 19 pp., illus. 1962.

This note reports an exploratory study by the Forest Service and the Hawaii Division of Forestry on the cost of treating posts by double-diffusion and on the establishment of a long-term test of their durability.

These are the steps in the double-diffusion treatment:

1. Debark and trim the ends of freshly cut posts.
2. Soak the posts for three days in a vat of 6 percent copper sulfate.
3. Soak the posts for three more days in a vat of 8 percent sodium chromate and sodium arsenate.

The chemicals diffuse into the green wood and react together to produce an insoluble preservative of copper chromate-copper arsenate.

TREATING PROCEDURE

CHEMICALS USED

We prepared two plywood vats ($2\frac{1}{2}$ x 3 x 8 feet) that could hold a batch of about 50 posts. A 6 percent copper sulfate solution was mixed in one vat by dissolving 0.75 pound of technical grade copper sulfate crystals per gallon of water. The other vat was filled with 8 percent sodium chromate and sodium arsenate by mixing 0.35 pound ($5\frac{1}{2}$ oz.) each of anhydrous sodium chromate and technical grade sodium arsenate for each gallon of water. About 300 gallons of each solution were mixed. After treating each batch, we added water to raise the solutions to the original level and slowly stirred in chemicals to attain the proper strength (specific gravity) of the solutions: 1.062 for copper sulfate and 1.085 for sodium chromate-sodium arsenate.

No more than two days before treatment, 8-foot posts were cut in the forest. Just before treatment, these posts were debarked and 6 inches cut from each end to eliminate dried wood. They were soaked in the copper sulfate solution for three days. Then they were removed, rinsed with water to remove surface copper sulfate, and soaked in the sodium chromate-sodium arsenate solution for three days. After this treatment the posts were again rinsed and then close piled for several days to allow chemicals to diffuse deeper into the wood.

SPECIES TREATED

Posts of 10 species were treated (table 1). All species except casuarina had been tested for acceptability of double-diffusion treatment in an earlier experiment.[2/] Casuarina was included because post-size trees grow abundantly in Hawaii. Ohia is the most common post material available and used in the state. Although it did not accept treatment particularly well in the earlier test, we included it to obtain more information.

2/ Smith, H. H., and Baechler, R. H. Treatment of Hawaiian grown wood posts by the double-diffusion wood preservation process. U.S. Forest Serv. Pacific Southwest Forest and Range Expt. Sta. Res. Note 187. 8 pp., illus. 1961.

Table 1.--Species, costs, and number of wood posts treated by double-diffusion

Species	Acceptance of treatment 1/	Debarking		Cost of treating per post (Debarking + $.22)	Posts set at exposure site		Percent of all posts with deep seasoning checks
		Man-hour per post	Cost per post ($2 hr.)		Treated	Untreated	
Brushbox (*Tristania conferta*)	Excellent	0.15	$0.30	$0.52	25	25	68
Bluegum eucalyptus (*Eucalyptus globulus*)	Good	.11	.22	.44	25	25	18
Casuarina (In Hawaii, "Ironwood") (*Casuarina* sp. *glauca*)	--	.09	.18	.40	25	10	17
Norfolk-Island-pine (*Araucaria excelsa*)	Excellent	.12	.24	.46	25	10	0
Ohia (*Metrosideros polymorpha*)	Fair	.06	.08	.30	26	25	57
Robusta eucalyptus (*Eucalyptus robusta*)	Good	.30	.60	.82	25	25	20
Saligna eucalyptus (*Eucalyptus saligna*)	Excellent	.10	.20	.42	25	25	26
Silk-oak (*Grevillea robusta*)	Good	.17	.34	.56	26	10	69
Sugi (*Cryptomeria japonica*)	Good	.10	.20	.42	26	25	22
Turpentine-tree (*Syncarpia laurifolia*)	Excellent	.24	.48	.70	26	25	2

1/ From Smith and Baechler (1961), a report on treatment of post butts in barrels.

COST OF TREATMENT

For most species debarking was the most expensive part of the treatment, ranging from $0.08 to $0.60 per post. The peeling was done with tools commonly found on ranches and farms--cane knives, draw knives, sickles, and axes. Though unskilled high school student labor did most of the debarking only the man-hours and wages of one skilled worker are shown in table 1.

The cost of treatment, other than debarking, amounted to $0.22 per post. It consisted of:

1. Two vats at $75 each, depreciated over 5 years at 1,000 posts per year--$0.03.
2. Initial chemical solution (600 gallons, $101.61) depreciated over 5 years at 1,000 posts per year--$0.02. (The initial chemical solutions were depreciated, since they may be used indefinitely with only minor additions of water and chemicals after each charge of posts.)
3. Chemicals used per post (0.297 pound of $CuSo_4$ and 0.212 pound of Na_2CrO_4 and Na_3AsO_4)--$0.17.

THE EXPOSURE TEST

To test their durability under actual service conditions, 254 treated posts and 206 untreated control posts were set out in September 1961. They were installed in a random pattern at the Makiki exposure site in lower Makiki Valley, Honolulu. We set the posts about 18 inches deep at 3-foot intervals.

The exposure site is infested with both subterranean and drywood termites, and is known to have a high potential for wood decay. The climate there is typical of many areas in Hawaii but does not span the extremely wide range of conditions found in the state. However, the site is considered to have enough hazards to wood so that results can be applied everywhere in Hawaii.

To obtain accurate estimates of durability for posts that may have a long service life, a minimum sample size of 25 posts has been recommended.[3/] For this reason at least 25 treated posts of each species and 25 untreated control posts each of all the more durable species were installed. Inspection of the posts at the exposure site are scheduled at periodic intervals to evaluate the effectiveness of the preservative treatment and to determine the expected service life of different species.

Some species treated by double-diffusion tend to check badly in seasoning. This checking exposes the untreated heartwood of the posts and may greatly reduce their service life. We recorded the severity of checking at the time of installation (table 1).

3/ Blew, J. O. Service tests on posts as a means of evaluating wood preservatives and methods of treatment. U.S. Forest Serv. Forest Products Lab. Rpt. 1726, 17 pp., illus. 1955.

A preliminary inspection of the posts at the exposure site was made in March 1962. We found that several of the smaller diameter (3 inches) untreated posts had failed and other untreated posts were nearing failure. Decay appeared to be the main cause of failure, although subterranean termites were also active.